

Shadow 200 Tactical Unmanned Aerial Vehicle (TUAV) System

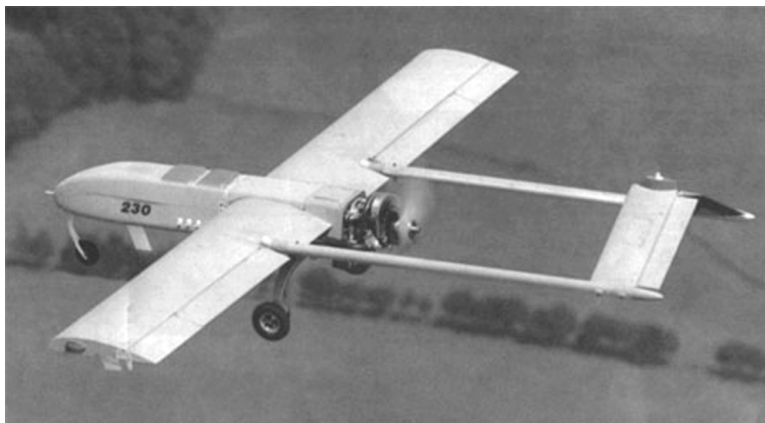
The Tactical Unmanned Aerial Vehicle (TUAV) system is intended to be a ground maneuver brigade commander's UAV and a critical component of the Brigade's intelligence collection package. The Shadow 200 is a small, lightweight, tactical UAV system. The system is comprised of air vehicles, modular mission payloads, ground control stations (GCS), launch and recovery equipment, and communications equipment. It will carry enough supplies and spare parts for an initial 72 hours of operation and will be transportable in two high mobility multi-purpose wheeled vehicles (HMMWVs) with shelters, and two additional HMMWVs with trailers as troop carriers. Another two HMMWVs carry the maintenance support section.

A single TUAV system includes three Shadow 200 air vehicles with a fourth air vehicle as part of the issued equipment of the maintenance section. The air vehicle has a wingspan of 12.3 feet and length of 11.2 feet. Power is provided by a commercial 38-horsepower rotary engine that uses motor gasoline. The payload has commercially available electro-optic and infrared camera and communications equipment for command and control and imagery dissemination. Onboard global positioning system instrumentation provides navigation information.

The air vehicle is intended to provide coverage of a brigade area of interest for up to four hours at 50 kilometers from the launch and recovery site. The maximum range is 125 kilometers (limited by data link capability) and operations are generally conducted from 8,000 to 10,000 feet above ground level during the day and 6,000 to 8,000 feet above ground level at night. The air vehicle uses a pneumatic launcher and is recovered by a tactical automatic landing system without pilot intervention on the runway. The air vehicle is stopped using an arresting hook and cable system.

The Army conducted a systems capability demonstration during October and November of 1999 to provide input to the TUAV source selection. In December 1999, a low-rate initial production (LRIP) contract was awarded to AAI Corporation for four Block I Shadow 200 TUAV systems. In March 2001, a second LRIP contract was awarded to AAI for four additional Block I systems. Originally, a Block upgrade program was envisioned to meet the full Operational Requirements Document (ORD) capability, however, lack of funding has reduced the scope of the Blocks. For example, the Shadow 200 TUAV has not incorporated required Tactical Control System (TCS) standards into its GCS as required by the Joint Requirements Oversight Council - approved TUAV and TCS operational requirements documents, although TCS compatibility was at one time part of the block upgrade program.

The TUAV first entered Initial Operational Test & Evaluation (IOT&E) in April of 2001. After two crashes during the first two days of flight, the test was halted pending accident investigations. The test resumed the following week, but was down-scoped to a limited user test. After two more crashes, the limited user test was terminated and all flight operations of the Shadow 200 stopped until a complete investigation was conducted. Flight operations resumed in the Summer of 2001 and the program office awarded a third LRIP contract for five more Block I systems in January 2002.



The Shadow 200 Tactical Unmanned Aerial Vehicle is a small, lightweight tactical unmanned aerial vehicle system.

ARMY PROGRAMS

A second IOT&E took place during April and May of 2002, and the Army authorized entry into full-rate production and deployment in October 2002. The current Test and Evaluation Management Plan (TEMP) was approved in March 2002. The TEMP is being updated for the upcoming follow-on test and evaluation phase.

TEST & EVALUATION ACTIVITY

Between October and December 2001, the program office performed a three-phase Operational Tempo (OPTEMPO) demonstration, to gain confidence in the reliability of the system after the problems that occurred during the canceled IOT&E. Successful demonstration of the ability of the system to perform a surge OPTEMPO was an entrance criterion for the second IOT&E.

Joint Interoperability Test Command (JITC) has periodically assessed the Command, Control, Communications, Computers and Intelligence interoperability of the TUAV ground control station with the Army's Joint Tactical Architecture, Battle Command System, and Joint Surveillance Target Acquisition Reconnaissance System Common Ground Station as is required by a Key Performance Parameter. After the first IOT&E, the test unit upgraded to a beta version of the Army Battle Command System. In all, JITC conducted three developmental test events with the TUAV and the beta software. JITC also observed the second phase of the OPTEMPO event. These events were aimed at mitigating risk going into the second IOT&E.

The second IOT&E was conducted from April 23 to May 6, 2002 at Fort Hood, Texas, with systems from the first LRIP lot. The test plan called for two phases, with each phase to last for five days. A TUAV ground control station was integrated into the 1st Brigade, 4th Infantry Division (Mechanized) Tactical Operations Center. The TUAV launch and recovery elements were set up at a tactical airstrip within Fort Hood ranges. Phase I was conducted in accordance with the Operational Mode Summary/Mission Profile while Phase II was conducted in a free-play exercise environment. The manner in which the Army executed this test was not in accordance with the test and evaluation plan submitted to the Director, Operational Test and Evaluation (DOT&E).

Regression testing of a production representative system from the second LRIP lot was conducted from September 23-27, 2002, at Fort Lewis, Washington. The testing was conducted in conjunction with the 3rd Brigade, 2nd Infantry Division's TUAV capstone fielding exercise (Stryker Brigade). The purpose of this testing was to confirm that there was no degradation in capabilities between the test article evaluated during IOT&E and a production-representative system.

TEST & EVALUATION ASSESSMENT

The TUAV successfully completed the first two phases of the OPTEMPO demonstration. The system also demonstrated 4 hours on-station at a 50 km equivalent range for a single mission (5 flight hours) three times. This was the first operational demonstration of this capability. Poor weather and airspace coordination severely limited the scope of the third phase. Of the 74 hours of on-station coverage required, the platoon was able to complete 20.7 hours. Data from the two previous phases were used to support the third LRIP production decision.

The scope of the 2002 IOT&E provided an excellent organizational environment for the TUAV platoon. The tactical scenario was representative of recent peace-keeping operations. However, test adequacy issues limited DOT&E's evaluation in some areas. For example, testers authorized the TUAV to fly over threat territory without penalty even though threat air defenses were able to detect and track the TUAV air vehicles. The unrestricted ability of the air vehicles to fly where desired eliminated the operational requirement for air vehicles to observe from realistic slant ranges and improved their opportunity to loiter over targets. Intelligence reports and artillery targeting results submitted under these conditions are most likely optimistic. In addition, because the data collected did not include all of the missions and taskings assigned to the TUAV platoon, the contribution to the commander's requirements and the overall reliability of the TUAV system could not be fully evaluated. Finally, the availability of additional air vehicles from Division and the Contractor Depot was optimistic since there will be at least three Brigade TUAV systems competing for these assets in realistic operational situations.

ARMY PROGRAMS

Results from the operational testing indicate that the Shadow 200 system is operationally effective under fair weather conditions and in the absence of an air threat for cued reconnaissance and surveillance missions. The Shadow 200 is not operationally effective for target acquisition missions. The TUAV system demonstrated the capability to contribute to the ground maneuver commander's requirement for timely and accurate reconnaissance and surveillance; 57 percent of the Shadow TUAV reports during the operational test were successful as scored against pre-determined mission success templates. However, median target location errors were determined to be in excess of 200 meters (the threshold requirement is 80 meters) and inadequate procedures to support accurate and timely artillery adjustment for second round fire for effect were observed.

Testing also revealed system performance limitations in the areas of air vehicle recovery and susceptibility to detection by threat systems. The ORD requires the TUAV to be able to move with a maneuver brigade and be able to launch and recover from an unprepared, soccer field-sized area. System limitations requiring an optimized landing site could negatively impact a maneuver commander's employment of this system.

The Shadow 200 system is not operationally suitable and may not be affordable. The TUAV executed 227 flight hours for a total of 170 hours on station during the 2002 IOT&E. Reliability has significantly improved since the first IOT&E in 2001; however, there were two AV crashes and one instance of an AV sustaining significant damage during a landing in which the tail hook missed the arresting gear and the AV went into the barrier net. The system did not meet its requirements for reliability or maintainability; inherent redundancy in the system allowed for operational availability well above the operational requirement and the system demonstrated its ability to meet the commander's sustained OPTEMPO. The frequency of occurrence of crashes, hard landings, and engine replacement raises concern that sustained operations and cost are prohibitive for the systems' intended use at this time.

The Shadow 200 TUAV is not survivable. Air vehicle susceptibility to detection was high as it was seen and heard within the effective ranges of many threat systems. Unsophisticated threats can also easily detect and locate the air vehicle and ground segment using electronic support measures. Electromagnetic environmental testing has revealed significant vulnerabilities. Finally, the system as tested has a data link with severe limitations on operating locations, and the planned upgrade to a C-band data link still has limitations in deployment locations outside the continental United States.

The JITC has not fully certified the TUAV system in accordance with DoD Directives because the testing was conducted using software versions of the required interfaces that have not been materially released. A specified interface certification was granted for only the configurations used during the operational test. Interoperability certification with the materially released fielded software versions is still necessary for compatibility with the majority of the Army in case of contingency operations.

The testing at Fort Lewis of the second LRIP lot did not have the rigor or length of an operational test. The platoon originally planned to conduct 24-hour flight operations for four days. Because of an air vehicle crash on the first day (following a crash landing the week prior), the planned schedule was not completed. If new failure modes have developed as a result of the changes to the system, they will probably not be illuminated until the system is operated in a more taxing manner over a longer period of time. Also apparent during this regression test was the fact that the personnel and training base infrastructure was not in place adequately for the successful fielding to the first units to be equipped. DOT&E continues to evaluate this finding.

